1.4 SCALE OPERATION

Knowledge of weighing systems by official personnel is essential for certification of weights. Specifically, this includes familiarity with the parts of each system, proper use of weighing systems, knowledge of procedures to be followed and of signs of system breakdowns. If the performance of the scale is questionable, the weigher must notify the supervisor and, if necessary, the scale official.

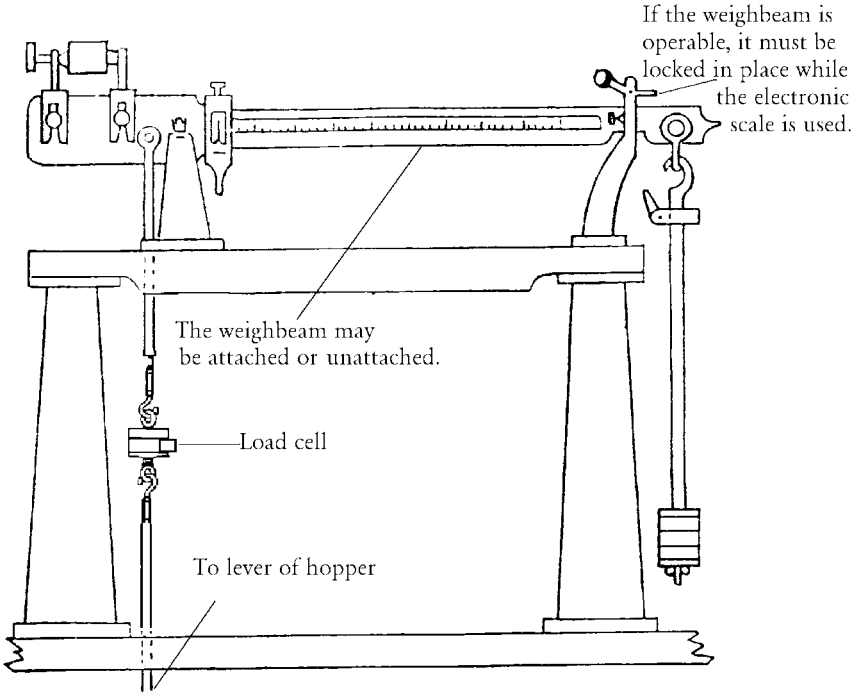
a. Electronic Weighing Systems

(1) General Description

An electronic weighing system includes a load receiving element, and indicating element, a printer, and the associated material handling equipment. The load cell(s) senses the amount of applied load in the load receiving element and produces an output voltage that is sent to the digital instrument. The digital instrument converts the output voltage into a digital display. The tape printer records the digital display to a tape or ticket for a permanent record. Resolve any problems with the supervisor and, if necessary, with the scale specialist.

(a) There are two types of electronic scales.

LEVERTRONIC SCALE

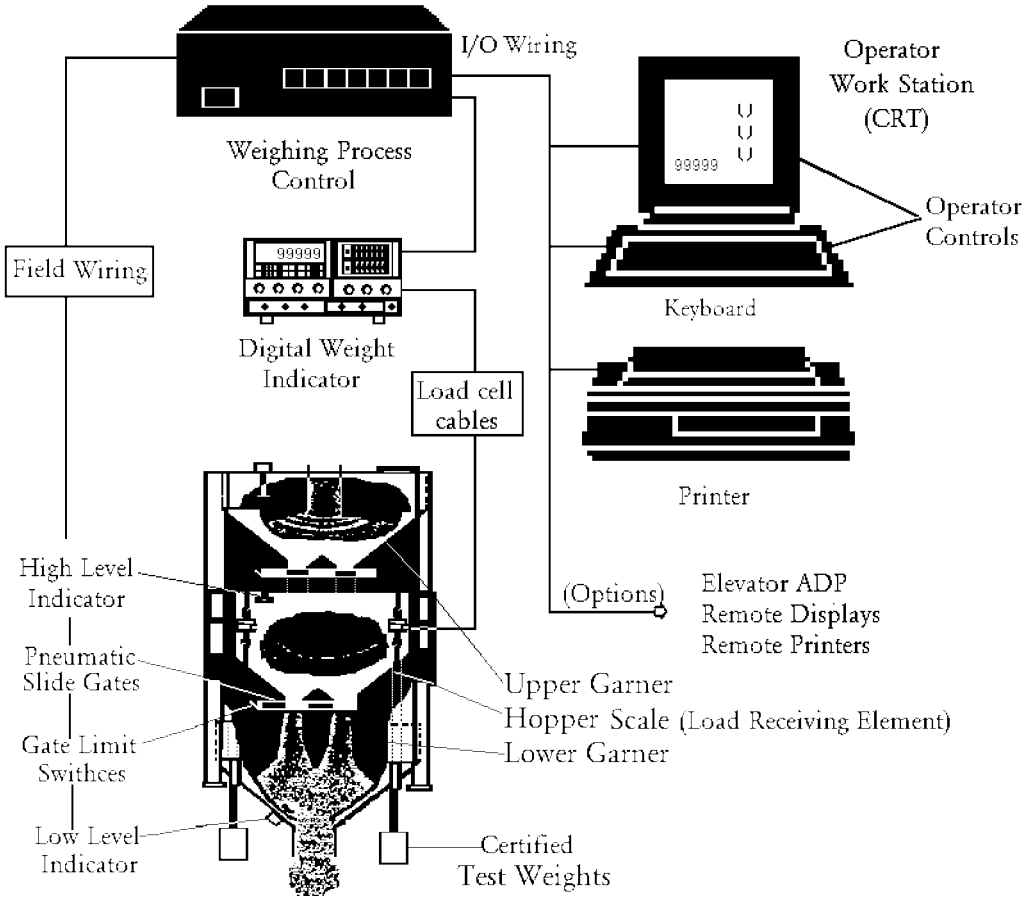


1) Levertronic Scale

Converted from mechanical scale by the insertion of a load cell into the lever system.

Digital instrument and printer usually replace weighbeam or dial.

FULL ELECTRONIC SCALE



2) Full Electronic Scale

Full electronic scales have load cells directly supporting the load receiving element.

Personnel control levertronic or full-electronic scales either in or out of the elevator, this area, the control room, contains digital instruments, printers, and control board monitors.

a) Official remote digital instrument displays (CRTs) and printers can be approved.

b) Digital instruments have a process control that allows operators to control grain flow into and out of garners and scales manually or by automatic mode. In the automatic mode, the scale fills and empties (cycles) by itself; manually, the operator controls the cycling of each draft.

Operators monitor grain flow from control boards or monitors that designate scaled diagrams of the elevator's grain handling system. Elevator personnel can control bin selection, tripper movement, diversion points, legs, conveyor belts, and slides/gates with switches on the control board.

(2) Pre-weighing Responsibilities

At the beginning of each work shift, the weigher must:

(a) Ensure the load receiving elements of the scale components are free from binds, obstruction, and debris; that the load cells and wiring are intact; and that all scale components are free from build-ups of grain.

(b) Ensure that there is a warmup period for the load cells and electronic units. One-half to one hour is required when power has been shut off to the scale.

(c) Examine the Scale Record Log to determine whether a malfunction occurred in the weighing system during the previous work shift. Resolve any problems with the scale official before using the scale for official weighing.

(d) Observe the digital display in an empty scale condition. If the weight value fluctuates in excess of plus or minus one division, determine if it is the result of a scale malfunction. No-load balance is a condition in which the scale will record a representation of zero load when the scale is empty.

(e) Establish for reference the operating tare. Tare is the reference amount that represents an empty scale condition; it is usually printed as a negative value on the scale tape. If the tare goes below zero:

1) The weighing cycle may stop.

The weight display will display below zero and print a positive tare. Net weight is obtained by subtracting (or adding if below zero) the tare weight from the gross weight.

2) Perform any other tests built into the weighing system which identify equipment problems (e.g., calibration check, printer check, LED display check, etc.), inform the supervisor, and consult the scale official as necessary.

(3) Electronic System Operating Procedures

(a) Ensure proper system operation and detect any printer malfunctions.

(b) Verify that the weight display value on the digital instrument is identical to the printed value on the scale tape or ticket.

(c) Document checks on scale tapes as instructed by manager.

(d) At the end of the sublot or pre-determined interval, total and record the sublot or tape number.

(e) Record the date, time, carrier identification, kind of grain, and scale number.

(f) Show the calculated net weight if it has to be manually calculated from a running total or verify the accuracy of the information.

(g) Initial the tape.

(4) Checks Performed During Each Work Shift

(a) Examine the garner gate and weigh hopper gate for leaks. Discontinue the use of the scale if a leak is found until it is corrected. Document on the Weight Loading Log, scale tapes, scale record logs, an event printer, as determined by the manager. Perform the check as follows:

1) With the garner at least 50 percent full, all gates closed, and the scale operation stopped; observe the digital display for a continuing increase in weight. An increase indicates that grain is leaking from the upper garner into the weigh hopper.

2) With the weigh hopper at least 50 percent full, all gates closed, and the scale operation stopped; observe the digital display for a continuing

decrease in weight. A decrease indicates that grain is leaking from the weigh hopper.

(b) Examine the gross weights from previous drafts printed on the scale tapes. If the grain flow to the scale is constant, the gross weights are constant. Large variations during automatic operation must be investigated by the scale official for a possible malfunction in the weighing system.

(c) Printed tare weights cannot vary more than two divisions.

1) Changes that do not necessarily indicate inaccurate weights:

a) Occasional increases that return to normal may indicate that material was struck in the weigh hopper for a brief period of time.

b) Gradual long-term increases may result from build-up on the scale structure or a temperature change. These do not necessarily indicate inaccurate weights.

2) Erratic changes or gradually decreasing tare weights must be investigated.

(d) During the print cycle, when the gates are closed, the digital display must settle to plus or minus one division prior to printing. A motion detection design, approved through the prototype and through initial installation examinations, senses the proper settling of the scale.

(5) Specific Situations Requiring Caution

(a) Design specifications on electronic hopper scales used for inbound weighing require that the tare weight is determined and printed at the beginning of each draft to reflect that the scale was empty when weighing began. Design specifications on scales for outbound weighing require that the tare weight is determined and printed at the end of each draft to reflect that all of the draft was delivered to the carrier.

1) Some scale models can change from one mode to the other simply by selecting the weighing sequence. Changing the weighing sequence while grain is in the weigh hopper and a draft is in progress can cause inaccurate results in the scale's total net weight accumulator. For example, when a carrier is being weighed in and is being directly transferred to export, there exists potential for this situation to occur. Often times the whole carrier is not used and many transfers and changes of mode of operation and weighing sequence occur. Weighers are to allow changes in weighing sequence only between carriers or a complete weighing cycle (a tare and gross).

2) Scales to weigh inbound may be used to weigh outbound if the scale is manually cycled while the scale is empty and by printing a tare and gross at the end of the weighing cycle. If scales to weigh outbound are be used to weigh inbound, specifically when shipping scales are used to weigh rejected grain back to the house and when shipping scales are used to weigh inbound grain, perform the procedure before the weighing cycle begins.

(b) Certified capacity of a scale is the maximum weight limit that has been approved for that scale and, along with the minimum division size, it must be conspicuously displayed on the front of the digital instrument. If draft weight exceeds certified capacity, do not certify the excess. For overdrafts, follow these procedures:

1) For outbound or export grain, the elevator may option to return grain to the house until the amount in the hopper is at or below certified capacity, or certify the weight of grain up to certified capacity.

2) For inbound grain, the elevator must discharge grain from the overloaded hopper until the amount in the scale is at or below certified capacity. Weigh the remaining grain in the hopper. Weigh the discharged grain. Add the net weight to the total net weight of the draft. If it is impossible to re-weigh the grain, certify the weight to certified capacity and place a qualified statement on the certificate indicating the number of drafts which exceeded certified capacity (see Chapter 2).

(c) Do not retain grain in the scale hopper beyond the normal operating cycle time except for emergencies, such as trimming a load or carrier cleanout. Consult the scale official if elevator management regularly requests retaining grain in a hopper.

(d) Limited access areas digital electronic scale instruments, including the manual printer, must always be sealed.

(e) Verify the remote tape with any other printer tapes three to four times per shift when it is the official tape.

(f) Where there is no battery backup and a power loss occurs, use one of the following procedures when the power is restored:

1) If an accumulated total is stored in the mechanical printer; weigh any grain remaining in the hopper, clear (total) the tape and add the drafts beginning with the last subtotal before the power loss, verify the total with the accumulated total registered by the printer, notify the supervisor of discrepancies, and document the situation.

2) If the accumulated total is stored in the electronic digital memory: calculate the tape manually to get the total, clear the printer, document the situation, and resume weighing.

(g) Precycling is the interruption of a normal weighing cycle to prevent the scale from completely filling the weigh hopper. Precycling will cause the tare weight to be abnormally high or the gross weight to be abnormally low, depending on when the precycling was initiated. Precycling must not be regularly allowed but is infrequently acceptable during emergency conditions such as the overfill of the upper hopper. Weighers must initial or explain these instances on the tape. At facilities where the upper garner often fills before the scale is ready to cycle, managers must provide procedures in the Facility Handbook explaining when precycling is condoned. (Such instructions may negate the requirement to initial all precycles.)

(6) Handling Malfunctions

(a) Any occurrence resulting in inaccurate or unverifiable weight information is a malfunction. A malfunction in any part of the electronic weighing system, regardless of its location, may adversely affect the entire weighing system.

(b) The weigher is neither responsible for determining the specific cause of a malfunction, nor for trouble-shooting the system, but is responsible for determining the accuracy of the results. Weighers must recognize the malfunction as it occurs, inform personnel responsible for identifying and correcting the malfunction, document the situation, and certify the weight according to Chapter 2.

(c) When the weight of the grain is questionable due to a malfunction, re-weigh the grain if possible. If the grain cannot be re-weighed, carefully consider every factor before certification. If the weigher and supervisor discontinue the use of the scale, the scale official determines when to resume using it. Record on the scale tape, Weight Loading Log, and Scale Record Log the date, time, and nature of the malfunction, and whether use of the scale was discontinued.

(d) Four areas in the weighing system where malfunctions occur are: 1) the operator; 2) the digital instrument; 3) the printer; and 4) the weighing mechanism.

(e) Weighers recognize malfunctions in electronic weighing systems by analyzing and understanding alarm or error messages on weighing system displays and printed messages. Messages vary with systems. Consult supervisors, Facility Handbooks, or manufacturer's operating manuals to be knowledgeable about the terminology. (Customized terminology used in process controls or other grain handling system controllers must be defined and explained in the Facility Handbook.)

(f) Operator errors cause some system malfunctions. Official personnel must know the manufacturer's operating procedures, evaluate the affect of errors on weight information, and make proper corrections. Improper use causes malfunctions that are not evident until after the error has been made, can occur any time during the weighing that involves the operator, and can have varying affects on printed weight totals. Proper observation of elevator operators by official personnel avoids or quickly rectifies operator errors.

(g) Continual use and unfavorable environmental conditions can have a detrimental affect on digital instruments. A breakdown within the instrument may affect the whole system. This instrument may control gates, printers and load cells, and it may receive signals from this equipment, including the first

indications of malfunctions in the equipment. Possible cause of the malfunction in this equipment is the digital instrument.

1) When a malfunction occurs and the weigher questions the accuracy of a digital instrument, the weigher must:

   a) Inform elevator personnel, supervisor, and scale official immediately.

   b) Cease all official weighing on the unit in question.

   c) Thoroughly document on appropriate tapes both the malfunction and subsequent action.

2) Common digital instrument malfunctions.

   a) Failure of the system to start, stop, or operate automatically.

   b) Printed weight totals, gross weights, and/or tare weights are incorrect or different from digital displays.

   c) Indicator lights cease to function or provide false readings.

   d) Digital display readout is illegible or incomplete.

   e) Control button switches are ineffective or work improperly.

   f) Digital display shows the filled or empty hopper is not settling.

(h) The printed tape is an official record of all weighing. Discontinue official weighing unless all the printed information is legible and accurate. Corrective action depends on the severity of the malfunction and can range from adjustment to replacement.

1) Common printer malfunctions.

a) Printovers because the paper is not advancing.

b) "Stretched" or illegible information because the paper advances while printing.

c) Lost print because the ribbon or printing element malfunctions.

d) Nonsense characters print.

2) Verify the flow of grain through the scale, when a printer malfunction occurs. The accumulated total can often be used for certification. (See auto-printing malfunctions in Section 2.4.)

3) Manually record the gross, tare, and net weight from the digital display on the digital instrument, if the printer stops. The supervisor decides when to allow official weighing in the manual mode. Note the circumstances on the scale tape.

(i) Scales are regularly tested to detect weigh system problems and to adjust or modify the equipment. Possible malfunctions in the load receiving element are:

1) Gates cease to function properly allowing scales to exceed capacity or leak;

2) Holes in the garner or weigh hopper allow grain to escape the system without being weighed;

3) Levers bind affecting the weighing accuracy of the scale; or

4) Load cell malfunctions.

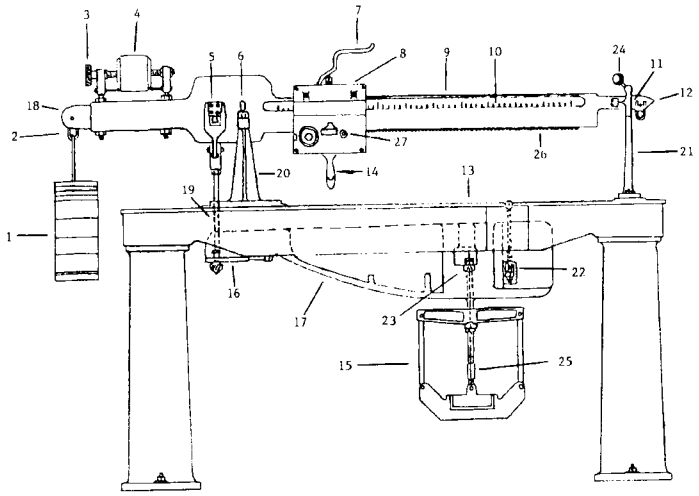
(j) Report repair work performed on the system's lever or load cells to the scale official to determine if testing is necessary.

b. Mechanical Type-Registering Weighbeam Scales

(1) General Description

Mechanical scales are either full capacity type-registering weighbeam or counterpoise type-registering weighbeam. The load receiving element (i.e., the weigh hopper and lever system) transfers the applied load (i.e., the weight of the grain) to the weighbeam, which contains apparatus to balance the scale and print the weight.

(a) There are two types of mechanical scales.



FULL-CAPACITY TYPE-REGISTERING WEIGHBEAM SCALE
Full-Capacity Weighbeam Parts List

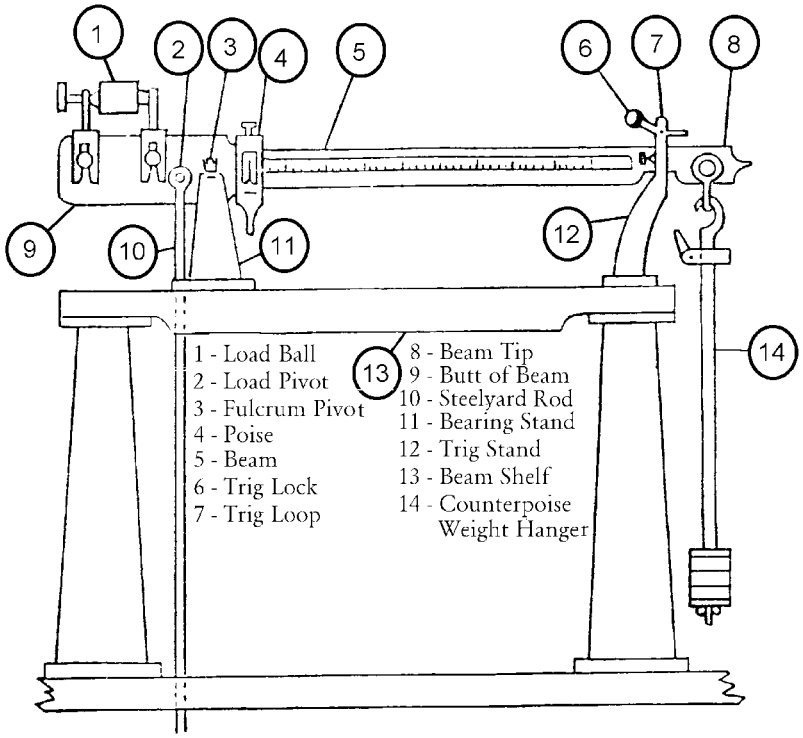
1. Counterbalance weights
2. Back balance loop
3. Balance ball knob
4. Balance ball
5. Final load pivot
6. Fulcrum pivot
7. Pawl handle
8. Recording beam poise
9. Weighbeam
10. Graduated bar
11. Trig loop
12. Beam tip or point
13. Beam shelf
14. Recording or printer loop
15. Shackle assembly
16. Nose iron assembly
17. Shelf lever
18. Beam butt
19. Beam rod
20. Beam stand
21. Trig stand
22. Fulcrum pivot
23. Load pivot
24. Trig lock
25. Steelyard rod
26. Type bar
27. Fractional poise

1) All weight is registered through the use of main and fractional poises.

   a) Fractional poises register less than 1,000 pounds.

   b) Thousands are registered by moving the main poise horizontally along the length of the weighbeam.

COUNTERPOISE TYPE-REGISTERING WEIGHBEAM SCALE



2) Counterpoise Type-Registering Weighbeam Scale

   a) Registers less than 1,000 pounds through horizontal movement along the weighbeam.

b) Registers thousands of pounds by placing counterpoise weights on the counterpoise weight hanger at the end of the weighbeam.

c) Punch the scale twice: Once for the thousands, and a second time for less than 1,000 pounds.

(2) Pre-weighing Responsibilities

(a) Ensure the lever system and load receiving elements are clean, and the scale components are free from binds, obstructions, and debris.

(b) Examine the Scale Record Log to determine whether a malfunction occurred in the weighing system during the previous work shift. Resolve any problems with the scale official before using the scale for official weighing.

(c) Balance the empty scale and maintain the balance while weighing continues. Verify the zero-load balance at least twice per shift or when resuming weighing after absence from scale. (The scale must be empty with no scale tickets in the poise.)

1) Balance a full capacity weighbeam scale by first setting the poises to zero, and then moving the balance ball to a position that attains correct zero balance. The weighbeam, when released at the top or bottom of the trig loop, must swing freely in the trig loop at an equal distance from the top and bottom, decreasing with each swing until it eventually comes to rest in the center of the trig loop. Where a balance indicator is used, the single indicator must swing an equal distance from and come to rest at the center of the graduated scale or central target area.

2) Balance a counterpoise type registering weighbeam by removing or releasing the counterpoise weights, setting the main poise to zero, and holding the weighbeam at the bottom or top of the trig loop and releasing. The weighbeam must swing freely from the top of the trig loop to the bottom and come to rest in the center. Adjust the balance ball to achieve a correct balance if necessary.

(3) Scale Operation Duties

(a) Recording Procedures

1) When the scale reaches draft weight, adjust the poise(s) and counterpoise weights as necessary to balance the beam.

2) Record the weight of each draft after obtaining the load balance and before moving the poise or removing the load from the weigh hopper.

3) Verify that the correct load balance for each draft is obtained, and that the printed weight on the scale ticket matches the weight value represented by the main poise or fractional poise and counterpoise weights position.

4) Operate the weight printing device while the load is on a correctly balanced scale.

5) Write in the correct weight and initial the correction if the printed weight value is unclear or incorrect.

6) Do not obtain the load balance while the scale ticket is in the poise.

(b) Operate Scale

1) Verify scale cleanout after each draft is balanced, the weight properly recorded, and the grain released from the weigh hopper.

2) Return the poise to zero and release the counterpoise weights.

3) Check the weighbeam when the draft runs out to verify that it is moving freely within the trig loop and the weigh hopper is completely empty.

4) Visually observe the inside of the weigh hopper for emptiness where counterpoise weights are not easily released or in other approved situations.

(c) Record weights of drafts with scale tickets when using a mechanical scale.

1) Draft weight is impressed on the ticket.

2) Write in and initial the correct weight when the ticket printer prints illegibly.

3) If illegible due to malfunction of the printer bar, notify the supervisor who notifies facility management.

4) Scale tickets must be numbered consecutively for accountability.

5) First and last scale tickets of a lot or sublot must show: draft weight, authorized or licensed weigher's initials, date, identification of grain (carrier), kind of grain, and scale number.

6) Remaining tickets need draft weight, scale number, and licensed or authorized weigher's initials.

7) Observe the balance of the beam for every draft for weighbeam scales.

8) Do not accept scale tickets for drafts not verified as weighed or not weighed.

9) For individual carrier (truck, railcar, etc.), enclose the scale ticket with or attach it to the agency copy of the appropriate certificate.

10) For multiple draft carrier, retain the scale tickets at a central secure location with other weighing documentation.

11) Calculate total pounds at the end of each cutoff or sublot and enter that weight on the Weight Loading Log.

12) Retain scale tickets for 5 years.

(4) Weighing Operation Checks

Perform the following procedures during each work shift, and if the scale's performance is questionable, notify the supervisor and, if necessary, the scale official.

(a) Check for required sensitivity a minimum of twice per shift.

1) Ensure that the interferences, weighbeam friction, or other factors do not impair sensitivity.

2) Moving the fractional poise two minimum divisions should cause the weighbeam to come to rest at the bottom of the trig loop, when the scale is balanced with the weighbeam at the center of the trig loop.

3) Changing a balance indicator one division when balanced, should cause a movement of at least ¼ inch or at least one division on the graduated scale (or the width of the central target area) whichever is greater.

(b) Examine the garner and weigh hopper gates for leaks on systems with hoppers.

1) Garner check: With the garner at least 50 percent full and all gates closed, stop the weighing cycle and balance the weighbeam. If the weight on the poise must be continually increased in order to maintain a balance, grain from the upper garner is leaking into the weigh hopper.

2) Weigh Hopper check: With the weigh hopper at least 50 percent full and all gates closed, stop the weighing cycle and balance the weighbeam. If the weight on the poise must be continually decreased in order to maintain a balance, grain is leaking from the weigh hopper.

3) If a leak is found do not use the scale until the system has been repaired and document the gate leak check on the Weight Loading Log.

(5) Specific Situations Requiring Caution

(a) The maximum weight certified or approved by FGIS for official weighing is the certified capacity and must be conspicuously displayed on the front of the weighbeam shelf. An overdraft occurs when grain fills the weigh hopper beyond its certified capacity. For overdrafts follow these procedures:

1) For Outbound or Export Grain, the elevator at its options may:

a) Return grain to the house until the amount remaining in the hopper is at or below the certified capacity of the scale and then have the remaining grain weighed; or

b) Have the weight certified for only the certified capacity of the scale. Do not certify a weight in excess of the scale's certified capacity.

2) For Inbound Grain:

a) Grain must be discharged from the overload hopper until the amount remaining in the scale is at or below the certified capacity;

b) Weigh the grain remaining in the hopper;

c) Weigh the discharged grain and add the net weight to the total weight of the draft; and

d) Certify the weight to the certified capacity and place a qualified statement on the certificate showing the number of drafts which exceeded the certified capacity, if it is impossible to re-weigh the grain (see Chapter 2).

(b) Any change in the poise weight seriously affects weighing accuracy. The poise of a weighbeam scale is carefully adjusted and sealed to a definite weight at the factory. Periodically check to see that no material is added to or removed from a poise.

(c) Sources of weighing error include foreign objects or loose material in the form of nuts, bolts, washers, or other material on any part of the weighbeam assembly, including the counter-balance hanger.

1) Loose balancing material must be enclosed in the shot cup of the counter-balance hanger.

2) Counter-balance weights must not be the slotted type which can readily be removed.

(d) Stops are provided on scale weighbeams to prevent movement of poises behind the zero division when balancing or weighing. If the stops become worn or broken and allow the poise to be set behind the zero position, report the condition to the supervisor.

(6) Handling Malfunctions

(a) When the accuracy of the amount of grain is questionable, re-weigh the grain if possible.

(b) If the grain cannot be re-weighed, carefully consider every factor before certification.

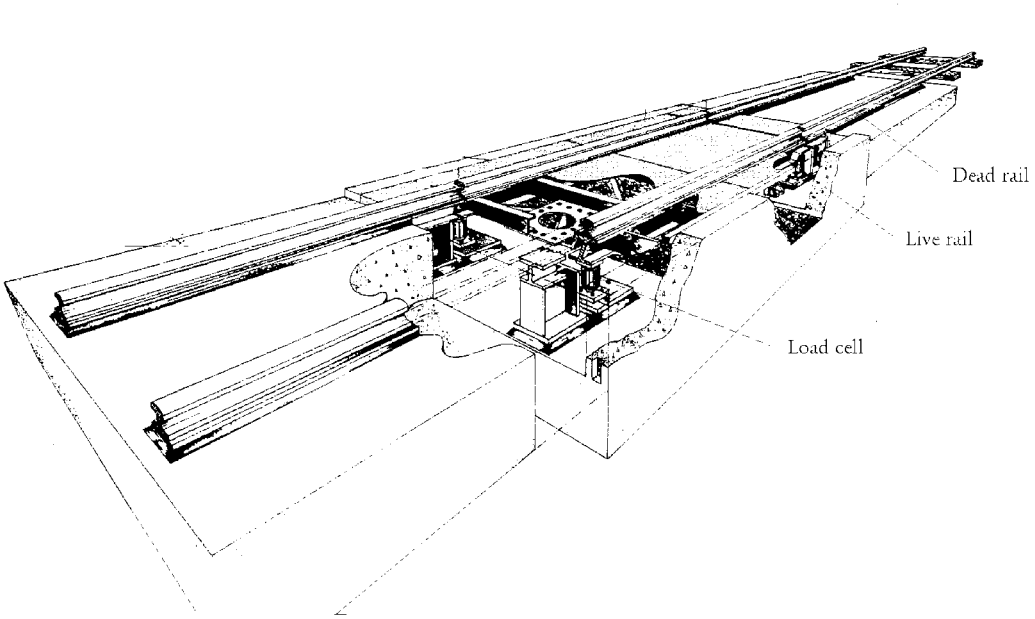
(c) If the weigher and supervisor discontinue the use of the scale, the scale official determines when to resume using it.

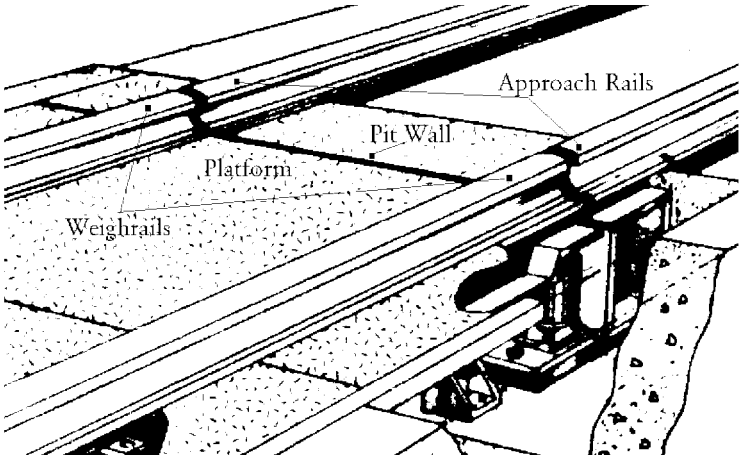
(d) Record on the scale tape, Weight Loading Log, and Scale Record Log, the date, time, and nature of the malfunction and whether the use of the scale was discontinued.

(e) Notify the supervisor or scale official when a scale has been adjusted (other than for zero balance) to determine if the scale requires retesting.

(f) Do not use the scale, if retesting is required, until the scale official approves it for use.

c. Railway Track Scales





(1) General Description

Procedures for balancing and operating the scale (electronic or manual) are explained earlier in this section. Procedures specific to the scale design follow. Seek approval from a scales official before weighing loads other than railcars on a railway track scale.

(2) Specific Requirements

(a) Inspect the levers, load cells, and scale pit for excessive grain debris or water build-up. Do not enter scale pits in confined work areas.

(b) Before balancing the empty scale, the scale platform must be free from interference or binds.

(c) An adequate clearance not less that 1/8 inch or more than 5/8 inch between the approach rails and weighrails must exist.

(d) No preset tare is used; *the scale must balance at zero* after each weighing (regardless of whether weighing is done on manual or electronic scales.)

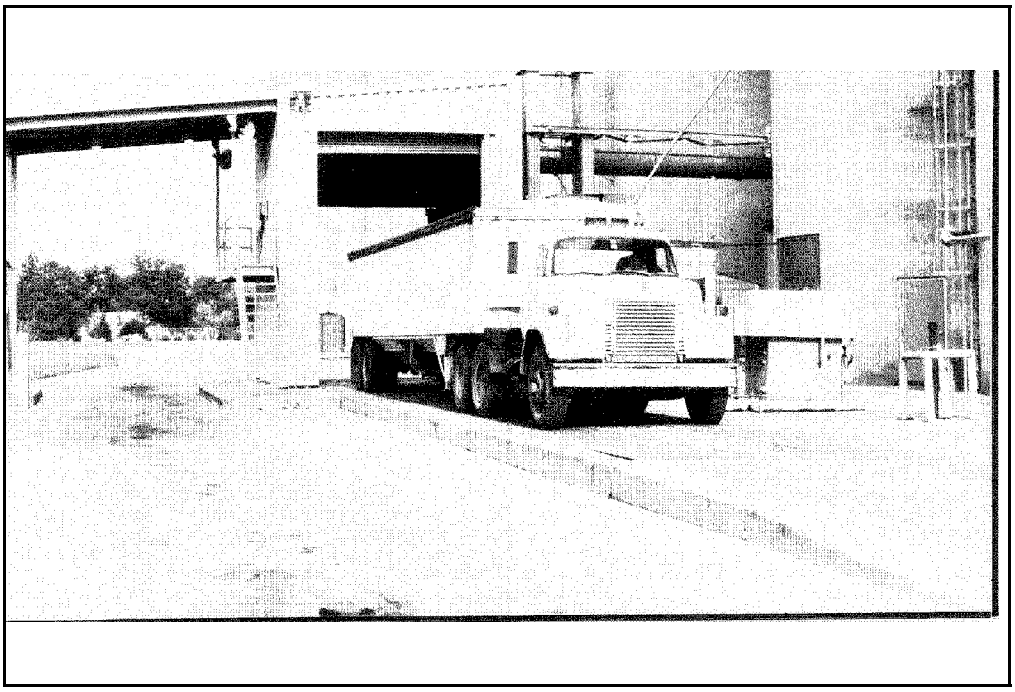
(e) Obtain the gross weight of a railcar in one weighing.

1) Ensure that the railcar is uncoupled at both ends and that all wheels are on the weighrails when the railcar is weighed.

2) In-motion weighing must be permitted only where scales have been approved for it.

(f) Obtain a correct tare weight of the unloaded railcar by weighing an empty car with all the grain doors, lumber, or other cooperage materials on the scale when the gross weight was obtained. (Do not use pre-determined or stencilled tare weights for empty railcars.)

VEHICLE/TRUCK SCALE



d. Vehicle/Truck Scales

(1) General Description

Procedures for balancing and operating the vehicle scale (electronic or weighbeam) are explained earlier in this section. Procedures specific to the scale design follow. Seek approval from a scales official before weighing loads other than vehicles on a vehicle scale.

(2) Specific Requirements

(a) Inspect the levers, load cells, and scale pit for excessive grain debris or water build-up. Do not enter scale pits in confined work areas.

(b) Check that there is adequate clearance -- 3/8 inches between the scale platform and pit walls.

(c) Periodically rebalance vehicle scales to zero, when the scale does not automatically reset itself to zero.

(d) Do not balance the scale during the weighing cycle of a truck.

(e) Obtain the gross weight of a tractor trailer or truck trailer in one weighing using vehicle scales.

(f) Obtain a correct tare weight of the unloaded vehicle by weighing the empty trailer with the same riders and truck accessories on the scale as when the gross weight was obtained.

(g) Do not use pre-determined tare weights for empty vehicles.

(h) Follow a consistent established policy of either weighing drivers and riders on or off the scales.

(i) Where the truck leaves the scale between the gross and tare weights, or the gross and tare weights are taken on different scales:

1) Check the zero balance every 30 minutes;

2) Notify the supervisor and scale official if the scale does not hold the zero balance for two consecutive checks; and

3) Continue to use the scale unless it malfunctions.

1.5 GRAIN FLOW SECURITY

Grain flow security is critical to the grain weight certification process. For official weighing of inbound grain, official personnel must ensure grain security from the unloading of the carrier to the completion of the weighing. For outbound grain movements, official personnel are responsible for correct weighing and for the secured movement of the grain from scale to carrier. A weight certificate attests to a known weight of grain in an identifiable carrier. The certificate must be accurate.

a. Detecting, Estimating, and Recording Grain Spills

(1) General Responsibilities

(a) When grain is spilled during shipping operations, collect and return sound grain to the grain flow, estimate and add a like amount of grain to the flow, or estimate and subtract from the weight credited to the carrier.